REMARKS

Claims 44-63 are presently pending in the case. Claims 44, 51, 57, 59 and 62 have been changed by this amendment to improve the form thereof.

The Examiner rejected claims 44-63 under the judicially-created doctrine of double patenting over claims 1-52 of U.S. Patent 5,731,804. To expedite prosecution, Applicant has submitted a terminal disclaimer herewith, and respectfully requests that the double patenting rejection be withdrawn.

The Examiner rejected claims 44-48 and 51-54 under 35 U.S.C. 103(a) as being unpatentable over Funda et al. or Gillio in view of Colston. Applicant respectfully disagrees, and has amended the claims to make the recited subject matter more clear. The Examiner stated that Funda discloses a joystick 268 and that it is well-known in the art of joysticks to form a device with a handle, elongated member, gimbal mechanism, and sensing system. However, the joystick 268 of Funda is not tracked to provide input to manipulate virtual reality images of a medical simulation. Rather, the joystick 268 is used by a surgeon performing an actual surgical procedure (not a simulated one) to move medical devices assisting the procedure, such as a medical telescope (col. 6, lines 57-58). The motions of the joystick 268 are not the motions of the medical instrument itself; rather, the joystick is just an additional control attached to the medical instrument to allow the surgeon to control other devices and functions. In contrast, Applicant's device provides a user object that simulates at least a portion of a medical instrument used in a laparoscopic surgical procedure, where the motions of the user object medical instrument are sensed in several degrees of freedom and provided to the computer to manipulate virtual reality images in the surgical simulation. An additional joystick control mounted on a medical instrument is not sensed in Applicant's claim.

The Examiner also cited Gillio, but this reference cannot be used in a 103(a) rejection since it has a later priority date (3/29/95) than the priority date of the present application (1/18/95).

The Examiner stated that it would have been obvious to have substituted the joystick of Colston to the joystick of Funda or Gillio so as to simplify on construction of the essential components in the six degree of freedom joystick. However, as explained above, the joystick of

Funda is not used as a simulated medical instrument in a virtual reality simulation, it is only an additional control for the surgeon used for other functions. Therefore, even if Colston is combined with Funda, the result is that the joystick control of Funda would use the force sensors of Colston to control other medical devices or functions. Colston mentions nothing about the use of a joystick or other device in a laparoscopic medical simulation, and thus there is no suggestion of Applicant's invention of claim 44. Claims 45-48 are dependent on claim 44 and are believed patentable over Funda, Gillio, and Colston for at least the same reasons as claim 44 and for additional reasons. For example, claim 48 recites a finger wheel which is not disclosed or suggested by the prior art references cited by the Examiner; Gillio, as mentioned above, is not prior art to the present application.

Claim 51 recites an apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation and includes a sensing system and an actuator to output a force in one or more of the degrees of freedom. Claim 51 is believed patentable over Funda, Gillio, and Colston for at least similar reasons as described above for claim 44. In addition, claim 51's actuator is not disclosed or suggested by Funda, Gillio, and Colston. Funda discloses a surgery system in which motors move medical instruments to perform actual surgery, and no forces are output to the user in a medical simulation. Gillio cannot be used as prior art against this application as noted above. Colston does not disclose actuators that output a force to the user or to the joystick in degrees of freedom of the user object, but rather only discloses force sensors FS1-FS6 that sense the amount of force applied to the joystick by the user, e.g. col. 2, lines 39-43. The actuators AM1-AM6, to which the Examiner refers, are the actuators on an apparatus being controlled, such as a manipulator arm or thrusters of a vehicle (col. 3, lines 23-44), and are not actuators used in the joystick that apply force to the user. Applicant therefore believes that claim 51 is patentable over Funda, Gillio, and Colston. Claims 52-54 are dependent on claim 51 and are believed patentable over Funda, Gillio, and Colston for at least the same reasons as claim 51 and for additional reasons.

In view of the foregoing, Applicant respectfully requests that the rejection of claims 44-48 and 51-54 under 103(a) be withdrawn.

The Examiner rejected claims 57-62 under 35 U.S.C. 103(a) as being unpatentable over Funda or Gillio in view of Colston and further in view of Noll. Claim 57 recites an apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation and includes a gimbal mechanism, sensing system and an actuator, where a capstan drum, cable, and pulley

transmit a force from the actuator to the user. Claim 57 is believed patentable over Funda, Gillio, and Colston at least for reasons similar to those explained above for claims 44 and 51. The Examiner stated that Noll discloses an actuator coupled to the gimbal mechanism through a cable and pulley. However, Noll discloses a standard belt and pulley system, not the capstan drum, cable, and pulley system recited in claim 57, which has advantages over a belt and pulley as described in Applicant's specification on pages 18-20, e.g., a belt introduces much more compliance into the system than a cable. Applicant therefore believes that claim 57 is patentable over Funda, Gillio, Colston, and Noll. Claims 58-62 are dependent on claim 57 and are believed patentable over these references for at least the same reasons as claim 57 and for additional reasons, and Applicant respectfully requests that the 103 rejection be withdrawn.

The Examiner rejected claims 49-50 and 55-56 under 35 U.S.C. 103(a) as being unpatentable over Funda or Gillio in view of Colston and further in view of Tuason. Claims 49-50 are dependent from claim 44 and claims 55-56 are dependent from claim 51, which are believed patentable over Funda or Gillio in view of Colston as explained above; Tuason also does not disclose or suggest the features of claims 44 and 51. Dependent claims 49-50 and 55-56 are believed patentable over unda or Gillio in view of Colston and further in view of Tuason for at least similar reasons, and Applicant respectfully requests that the rejection be withdrawn.

The Examiner is respectfully requested to consider and allow the presently pending claims. Should the Examiner have any questions, the Examiner is requested to call the undersigned at the number given below.

Respectfully submitted,

IMMERSION CORPORATION

Dated: April 22, 2002

By: _____

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MARKED-UP VERSION OF AMENDMENTS

In the claims:

The following is a complete listing of a clean version of the presently pending claims; claims amended hereby are so indicated by the parenthetical expressions "amended":

44. (amended) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object simulating at least a portion of a medical instrument used in a laparoscopic surgical procedure, said user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a closed-loop five member linkage to provide the first and second rotary degrees of freedom; and

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom, wherein said sensing system provides sensor input related to said manipulation in said first, second, and third rotational degrees of freedom and said first translation degree of freedom to said computer to control a virtual reality image in said laparoscopic surgical simulation displayed on a display device by said computer.[;]

[whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation.]

45. An apparatus according to claim 44 further comprising a handle sensor coupled to the handle to detect manipulation of at least a portion of the handle.

46. An apparatus according to claim 44 wherein the handle comprises relatively pivotable portions.

47. An apparatus according to claim 46 further comprising a sensor coupled to the handle to detect relative motion of the pivotable portions.

48. An apparatus according to claim 44 wherein the handle comprises a finger wheel.

49. An apparatus according to claim 44 further comprising a barrier between the handle and the gimbal mechanism.

50. An apparatus according to claim 44 further comprising a trocar between the handle and the gimbal mechanism.

51. (amended) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object simulating at least a portion of a medical instrument used in a laparoscopic surgical procedure, said user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a closed-loop five member linkage to provide the first and second rotary degrees of freedom;

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom, wherein said sensing system provides sensor input related to said manipulation in said first, second, and third rotational degrees of freedom and said first translation degree of freedom to said computer to control a virtual reality image in said laparoscopic surgical simulation displayed on a display device by said computer; and

an actuator coupled to the gimbal mechanism to output a force to the user in one or more of the degrees of freedom, wherein the actuator outputs one or more forces associated with the simulation. [;]

[whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.]

52. An apparatus according to claim 51 wherein the actuator comprises a motor.

53. An apparatus according to claim 51 wherein the actuator comprises a braking mechanism.

54. An apparatus according to claim 51 further comprising additional actuators so that forces may be output in each of the first, second, and third rotational degrees of freedom and in the first translational degree of freedom.

55. An apparatus according to claim 51 further comprising a barrier between the handle and the gimbal mechanism.

56. An apparatus according to claim 51 further comprising a trocar between the handle and the gimbal mechanism.

57. (amended) An apparatus for interfacing a user with a computer providing a laparoscopic surgical simulation, the apparatus comprising:

a user object simulating at least a portion of a medical instrument used in a laparoscopic surgical procedure, said user object comprising a handle and an elongated member;

a gimbal mechanism receiving the user object and allowing the user object to be manipulated in first, second and third rotary degrees of freedom and in a first translational degree of freedom, the gimbal mechanism comprising a five member linkage;

a sensing system coupled to the gimbal mechanism to detect manipulation of the user object in the first, second, and third rotational degrees of freedom and in the first translational degree of freedom, wherein said sensing system provides sensor input related to said manipulation in said first, second, and third rotational degrees of freedom and said first translation degree of freedom to said computer to control a virtual reality image in said laparoscopic surgical simulation displayed on a display device by said computer; and

an actuator coupled to the gimbal mechanism, wherein [through] a capstan drum, cable and pulley [to output] transmit a force from said actuator to the user in one or more of the degrees of freedom, wherein the actuator outputs one or more forces associated with the simulation. [;]

[whereby the sensing system provides input to the computer to control the laparoscopic surgical simulation and the actuator outputs one or more forces associated with the simulation.]

58. An apparatus according to claim 57 wherein the actuator is coupled to the gimbal mechanism through the cable and pulley to provide a force to the user in the first translational degree of freedom.

59. (amended) An apparatus according to claim 57 wherein [the gimbal mechanism comprises a] said five member linkage is a closed-loop linkage and provides [to provide] the first and second rotary degrees of freedom of the gimbal mechanism.

60. An apparatus according to claim 59 wherein the actuator is coupled to the five member linkage through the cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

61. An apparatus according to claim 60 further comprising a second actuator coupled to the five member linkage through another cable and pulley to provide a force to the user in the first or second rotary degrees of freedom.

62. (amended) An apparatus according to claim 57 wherein the cable transmits a force from the pulley to [a] the capstan drum, the capstan drum being rigidly coupled to a linkage of the gimbal.

63. A system for training persons to perform a surgical procedure using a surgical instrument that is inserted and manipulated through a small incision in a patient, said system comprising:

a housing with an opening;

an implement for simulating said surgical instrument that is situated in said opening in said housing and manipulated axially and rotationally relative to said housing;

a movement guide and sensor assembly for monitoring the position of said implement relative to said housing, said movement guide and sensor assembly having:

a) a cable;

b) a guide rail proximate to said cable;

c) a framed assembly for restricting the linear motion of said implement as it is moved relative to said housing to a predetermined axis;

d) a rotation sensor affixed to said implement for monitoring the axial rotation of said implement relative to said housing;

e) a position sensor for monitoring the axial position of said framed assembly; and

f) a servo motor applying a torque to said cable, which imparts a resistive force to linear motion of said implement;

a display; and

a processor for interpreting the data from said rotation sensor and said position sensor to determine the location and occurrence of force feedback to said implement, said force feedback created by said processor controlling said servo motor in response to said sensed applied force, said processor also controlling a visual simulation for said display.

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